

Furthermore, the junction described above can be produced by microelectronics methods. This means that it can easily be produced while the integrated circuit is fabricated.

In some embodiments, the first and second electrical conductors comprise, respectively, first and second extensions driven into the substrate to electrically connect the first and second ends, respectively, to the first and second bump contacts, these first and second extensions comprising, respectively, a first and a second cylinders arranged inside one and the same blind via at least 5 μm deep formed from a face of the substrate, at least the distal ends buried inside the substrate of the first and second cylinders being produced, respectively, in the first and second materials to form, respectively, the first and second buried ends of the first and second electrical conductors, these first and second cylinders extending inside the via from the face of the substrate to, respectively, the first and second ends, and the integrated circuit also includes least a layer of electrical insulator situated everywhere between the first and second cylinders except between the first and second ends.

In other embodiments, the first and second electrical conductors comprise, respectively, first and second extensions driven into the substrate to electrically connect the first and second ends, respectively, to the first and second bump contacts, the first extension comprising a first cylinder, at least the distal end of which buried inside the substrate is produced in the first material to form the first end of the first electrical conductor, this first cylinder extending inside a first via formed from a first face of the substrate to the first end, the second extension comprising a second cylinder, at least the distal end of which, buried inside the substrate, is produced in the second material to form the second end of the second electrical conductor, this second cylinder extending inside a second via to the second end, this second via being formed from a second face of the substrate situated on the side opposite the first face, the bottom of the second via emerging on the first end of the first cylinder.

In yet other embodiments, the substrate forms a first substrate having a top face, and the circuit comprises a second substrate having a bottom face directly joined to the top face of the first substrate and a top face on the side opposite its bottom face, these first and second substrates joined together forming, respectively, first and second layers of a third, thicker substrate, these layers extending essentially parallel to the plane of the third substrate, a blind via first and second vias being formed from the face or faces of the first substrate, and the second substrate comprising third and fourth bump contacts arranged on its top face and electrically connected, respectively, to the first and second bump contacts.

In other embodiments, the substrate comprises at least one first layer having a top face and one second layer having a bottom face, assembled directly on the top face of the first layer, these layers extending essentially parallel to the plane of the substrate, the first and second electrical conductors comprising, respectively, first and a second conductive tracks produced on the top face of the first layer or on the bottom face of the second layer and extending essentially parallel to the plane of the substrate, distal ends of these tracks situated between the first and second layers forming, respectively, the buried first and second ends of the first and second electrical conductors.

Among these embodiments are those in which the distal ends of the first and second tracks overlap one another in a direction at right angles to the plane of the substrate.

Also among the embodiments are those in which the first and second conductors comprise, respectively, first and

second extensions driven into the substrate to electrically connect the first and second tracks, respectively, to the first and second bump contacts, at least one of the extensions being formed via a via passing right through the first or the second layer.

In some embodiments, the shortest distance between each bump contact and the junction is at least greater than 50 μm .

These embodiments of the integrated circuit also offer the following advantages:

An advantage to the foregoing integrated circuit is that producing the junction at the bottom of a blind via is simple to produce using microelectronics fabrication methods.

Another advantage is that the production of the junction at the place where two vias hollowed out from opposite outer faces meet is simple to carry out by microelectronics fabrication methods and makes it possible to avoid the production of an insulating layer interposed against the first and second cylinders of the first and second electrical conductors.

Another advantage is that the production of the junction from first and second conductive tracks produced on faces of layers attached to one another makes it possible to produce a junction situated inside the substrate in a relatively simple manner.

An advantage of overlapping the ends of the first and second tracks that form the junction is that it becomes possible to increase the contact surface area and increase the sensitivity of the temperature measurement.

An advantage of using through-vias to connect the junction to the bump contacts situated on an outer face of the substrate is that it becomes possible to bury the junction more deeply.

An advantage of spacing the bump contacts at least 50 μm away from the junction is that it makes it possible to increase the accuracy of the measurement.

In another aspect, the invention features a method for fabricating an integrated circuit equipped with a temperature probe. Such a method includes (a) the supply of a substrate extending essentially in a substrate plane, (b) the production on a surface of the substrate and/or inside the substrate of at least one electronic component of the integrated circuit, (c) the production, by microelectronics methods, of a first electrical conductor comprising a first bump contact on a surface of the substrate and a first end, the first electrical conductor being electrically insulated from the substrate, and (d) the production, by microelectronics methods, of a second electrical conductor comprising a second bump contact on a surface of the substrate and a second end, the second electrical conductor being electrically insulated from the substrate and electrically insulated from the first electrical conductor except at the second end which is mechanically and electrically directly in contact with the first end to form an electrical junction, in which, in steps (c) and (d), the first and second ends are entirely buried to at least 5 μm depth inside the substrate and produced, respectively, in different first and second materials chosen for the absolute value of the Seebeck coefficient of the junction to be greater than 1 $\mu\text{V/K}$ at 20° C. such that the combination of these first and second conductors forms the temperature probe.

In some practices steps (c) and (d) comprise the production of first and second extensions, driven into the substrate to electrically connect the first and second ends, respectively, to the first and second bump contacts, the production of these extensions comprising: (1) the formation of a blind via at least 5 μm deep from an outer face of the substrate, (2) the deposition inside the same via of a first and a second cylinders of which at least the distal ends buried inside the